REMARKS/ARGUMENTS

Overview of the invention: Unwanted thermal expansion of the main pole of a magnetic write head is prevented by thermally connecting the write coil to the substrate. This is done through a thermally conductive pedestal that extends upwards from the substrate and is in turn connected to the coil though a thermally conductive layer

Reconsideration is requested of all rejections based on objections to the abstract:

A new abstract that conforms to the guidelines provided by examiner has been provided.

Reconsideration is requested of all rejections based on objections to the specification:

Examiner's statement that there is "no antecedent basis in the specification for the microstructure as recited in the claims" is not understood. In addition to the various elements that relate to a magnetic write head, the invention claims two novel features whose purpose is to cool the write coil. The latter is referred to in the specification as element 17 and can be seen in FIGs. 3-7. The first novel feature is the thermally conductive pedestal which is referenced as element 23 and can be seen in FIGs. 2-5. The second novel feature is thin film 41 which provides a high thermal conductance path between the coil and the pedestal and can be seen in FIGs. 4 and 5.

Claim 1 reads as follows (element numbering added):

1. A method to dissipate heat generated by a coil (17) located within a micro-structure, that is on a substrate, (10) comprising:

forming a thermally conductive pedestal (23) that originates at said substrate and extends upwards therefrom; and

forming a layer of thermally conductive material (41) that thermally connects said coil to said substrate through said pedestal.

Similarly for claim 25.

Note that the high thermal conductance path between the coil and the substrate constitutes a thermal short circuit between the coil and the substrate. Without it, heat from the coil would have to pass through several low thermal conductance layers, particularly layer 19. See later discussion below.

Reconsideration is requested of the rejection of claims 3 and 27 under 35 U.S.C. 112:

The term 'contact' was introduced to serve as a descriptor, not a new element, and should not have required antecedent basis, any more than 'proximity' as used in 'in proximity to' would require antecedent basis. We have, however, replaced 'from contact with' by 'originates at' which should leave no doubt as to which structures are involved.

Reconsideration is requested of the rejection of claims 1, 3, 4, 25, 27, and 28 under 35 U.S.C. 102(b) as being anticipated by Jensen et al.

Jensen attempts to solve the coil overheating problem, in part, by underlying the coil with layer 532 made of a remarkable material – one that, **in thin film form,** is both a good electrical insulator and a good thermal conductor. The preferred materials for this layer are stated to be aluminum nitride or silicon nitride whose thermal conductivities **when in bulk form** approach the values cited by Jensen. This high thermal conductivity (for an insulator) is achieved, in the bulk material, through lattice conduction. Were it otherwise they could not be good electrical insulators. However, when laid down as thin films, good lattice conductivity no longer possible. Even if the films were monocrystalline, phonon reflection at the film's interfaces would further reduce its thermal conductivity. We will discuss this further below.

Quite aside from the inoperability of this portion of the Jensen invention, there is no teaching by Jensen of how the heat absorbed by layer 532 is to be removed from the vicinity of the coil. As can be seen in figure 5, this absorbed heat must pass through lower pole 512, dielectric layer 508, and lower shield 510 before reaching substrate 506. The two "pedestals" 522 and 524, cited by examiner extend only as far as layer 518. Unlike the present invention, there is no thermal short circuit (to convey heat directly to the substrate) equivalent to that provided by our pedestal 23.

Examiner has rejected this last argument on the grounds that 'thermal short circuit' is not recited in the rejected claims. We do understand that features that are described in the specification cannot be used in the defense of claims unless they also are present in the claims. Examiner appears to have now extended this rule to any argument that employs terminology that is not word-for-word the same as that used in the claims. As we have explained above, the sub-structure comprising elements 23 and 41 in our FIG. 5 is a thermal short circuit between the coil and the substrate. Our argument is that Jensen's invention does not include a sub-structure that performs a

similar function. The fact that we do not use the term 'thermal short circuit' in our claims has no bearing whatsoever on this argument.

Reconsideration is requested of the rejection of claims 2, 5, 6, 26, and 29 under 35 U.S.C. 103(a) as being unpatentable over Jensen et al.

Regarding claims 2 and 26, examiner argues that it would have been obvious for one skilled in the art to select an insulating material having a thermal conductivity in the range recited in claims 2 and 26. With the greatest respect we had requested that examiner provide us with a single example of a material that, in thin film form, has been reported to be both a good electrical insulator and to have a thermal conductivity in the range 100 to 400 W/m.K.

Examiner has not responded to this request but has, instead, required us to produce objective evidence to the effect that NO deposited film has EVER been reported to be both a good electrical insulator and to have a thermal conductivity in the range 100 to 400 W/m.K.

As examiner surely knows, it is impossible to prove a negative since we would need, in principle, to survey ALL films ever deposited. On the other hand, since examiner contends that it would be obvious to use such a film, we must assume that examiner believes that such films exist and examiner should therefore have no difficulty providing a SINGLE example of such a film, as we had requested.

As we explained earlier, heat is conducted through solids via two carrier types. The first type comprises free electrons, which makes all electrical conductors good thermal conductors (Wiedemann-Franz law). The second type comprises phonons which are lattice supported sound waves. Phonons are readily scattered by imperfections, particularly at grain boundaries, interfaces, and surfaces. The latter are

especially important in the case of thin films since phonon wavelengths range from a few microns to as little as a nanometer, so even a structurally perfect film will suffer a reduction in thermal conductivity relative to the bulk material, simply because of its thickness.

In an attempt to comply with examiner's requirement of objective evidence, we are attaching abstracts from three recently published papers. If these do not satisfy examiner we can, if necessary, obtain an affidavit from a recognized expert in this field but we are reluctant to burden our client with the associated expense unless absolutely necessary.

Reference 1 (Sun Rock Choi et al.) confirms that the thermal conductivity of thin films is significantly less than the bulk material.

Reference 2 (Jungho Mun et al.) shows that the thermal conductivity of as-deposited titania films is in the range of 0.7-1.7 $Wm^{-1}K^{-1}$.

Reference 3 (Jansen and Obermeier) gives a value of 4 $Wm^{-1}K^{-1}$ for a diamond film. We note that diamond is recognized as having the greatest thermal conductivity of any known electrically insulating material.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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